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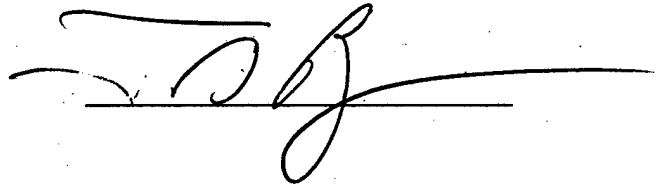
Is the Day of the Aircraft Carrier Over?

by

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A paper submitted to the Faculty of the Naval War College in partial satisfaction of the requirements of the Department of Joint Military Operations.

The contents of this paper reflect my own personal views and are not necessarily endorsed by the Naval War College or the Department of the Navy.

A handwritten signature in black ink, appearing to read 'J. D. Burpo', written over a horizontal line.

18 May 1998

A handwritten signature in black ink, appearing to read 'P. A. Romanski', written over a horizontal line.
CAPT P. A. Romanski

REPORT DOCUMENTATION PAGE

1. Report Security Classification: UNCLASSIFIED			
2. Security Classification Authority:			
3. Declassification/Downgrading Schedule:			
4. Distribution/Availability of Report: DISTRIBUTION STATEMENT A: APPROVED FOR PUBLIC RELEASE; DISTRIBUTION IS UNLIMITED.			
5. Name of Performing Organization: JOINT MILITARY OPERATIONS DEPARTMENT			
6. Office Symbol: C		7. Address: NAVAL WAR COLLEGE 686 CUSHING ROAD NEWPORT, RI 02841-1207	
8. Title (Include Security Classification): Is the Day of the Aircraft Carrier Over? (U)			
9. Personal Authors: CDR J.D. Burpo, USN			
10. Type of Report: FINAL		11. Date of Report: 18 May 1998	
12. Page Count: 19			
13. Supplementary Notation: A paper submitted to the Faculty of the NWC in partial satisfaction of the requirements of the JMO Department. The contents of this paper reflect my own personal views and are not necessarily endorsed by the NWC or the Department of the Navy.			
14. Ten key words that relate to your paper: Forwar Deployed; procurement; operation; defense resources; information superiority; technological innovations			
15. Abstract: The aircraft carrier has ben the mainstay of the U.S. Navy's operational forces for over fifty years. Aircraft carriers, with crew sizes of almost 6,000, are routinely forwar deployed around the globe. The prôcruement, operation, and decommissioning of aircraft carriers, pratically nuclear powered versions, represent an enormous investment of increasingly scarce defense resources.			
16. Distribution / Availability of Abstract:	Unclassified X	Same As Rpt	DTIC Users
17. Abstract Security Classification: UNCLASSIFIED			
18. Name of Responsible Individual: CHAIRMAN, JOINT MILITARY OPERATIONS DEPARTMENT			
19. Telephone: 841-6461		20. Office Symbol: C	

Abstract of

Is the Day of the Aircraft Carrier Over?

The aircraft carrier has been the mainstay of the U.S. Navy's operational forces for over fifty years. Aircraft carriers, with crew sizes of almost 6,000, are routinely forward deployed around the globe. The procurement, operation, and decommissioning of aircraft carriers, particularly nuclear powered versions, represent an enormous investment of increasingly scarce defense resources.

The rapid pace of technological advancement means that many U.S. national defense mainstays of our armed services may be antiquated within the next 25 years. With smaller surface ships potentially carrying hundreds of precision conventional strike weapons, and accurate target acquisition provided by Information Superiority, will the aircraft carrier become an antiquated weapon system in the 21st century? Will the Joint Force Commander be able to rely on the aircraft carrier in 2010, or will other forces be more adept and efficient at utilizing Technological Innovations and Information Superiority to provide Dominant Maneuver, Force Protection, Precision Engagement, and Focused Logistics in order to conduct Decisive Operations? These are questions that should be answered by the leadership of the U.S. Navy before America embarks on an expensive program to construct the follow-on to the Nimitz class aircraft carrier and its requisite airwing.

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Introduction

The aircraft carrier has been the mainstay of U.S. naval operations for over fifty years. The U.S. Navy's first aircraft carrier, a converted collier named USS Langley (CV-1), was commissioned at Norfolk, Virginia, on March 20, 1922.¹ At present, with construction in progress of the last of the Nimitz class carriers, and design work initiated on the next generation carrier (CVX), this is an opportune time to examine the requirement for an aircraft carrier in the force structure of the future. Utilizing the framework of Joint Vision 2010 (JV 2010) and its likely successors, this paper will address the following questions: will technological developments send the aircraft carrier the way of the battleship, the horse mounted cavalry, and the long bow? Are there more effective alternatives to the aircraft carrier, either now or on the horizon? In view of budgetary constraints that are likely to be continuous, are there more cost efficient alternatives to the aircraft carrier? If the aircraft carrier era will end in the foreseeable future, will it take another "Pearl Harbor" type episode for the Navy leadership to recognize this fact?

The Aircraft Carrier in the 21st Century U.S. Navy

The three components of U.S. National Military Strategy are peacetime engagement, deterrence and conflict prevention, and "fight and win" when deterrence fails. A key advantage of forward deployed naval forces in general, and aircraft carriers in particular, is that they provide a wide range of capabilities relevant to executing these three components of

¹ "A Brief History of U.S. Navy Aircraft Carriers." U.S. Navy - A Brief History of Aircraft Carriers. <<http://www.chinfo.navy.mil/navpalib/ships/carriers/cv-why.html>> (29 March 1998)

the National Military Strategy, and can do so without infringing on any nation's sovereignty.²

With the break up of the Soviet Union and the end of the Cold War, the U.S. Navy recognized that a new strategic direction was required. The shift from its previous emphasis on "blue water," open ocean warfare on the sea, to the conduct of joint operations in the littoral was formalized in a White Paper titled *From the Sea, Preparing the Naval Service for the 21st Century* published in 1992.³ While some have called this White Paper a revolutionary shift in the Navy's vision statement, the fundamentals it contains are not significantly different from those put forth in 1978 by former Secretary of the Navy, John Lehman. Mr. Lehman accurately described the engagement, deterrence, and war fighting strategic missions of the Navy, and summarized the Navy's primary mission as "sea control, and related projection ashore."⁴ An emphasis on joint operations was formalized with the publication of Joint Vision 2010, which presents a framework of warfighting in the early part of the 21st century for the U.S. armed forces.⁵ Specifically, "Joint Vision 2010 provides the template for joint combat operations in the 21st century and envisions future joint combat operations, leveraging information superiority to execute dominant maneuver, precision engagement, full dimensional protection and focused logistics."⁶

The implementation of Joint Vision 2010 is directed toward achieving a set of capabilities, comprising the core competencies of each Service, which are presumed to be

² Forward ... From The Sea: The Navy Operational Concept. (Washington, D.C.: Chief of Naval Operations, March 1997), 2.

³ ...From the Sea, Preparing the Naval Service for the 21st Century. (Washington, D.C.: Department of the Navy, 1992), 1-10.

⁴ John Lehman, "Aircraft Carriers: The Real Choices," The Washington Papers, Vol. VI. (Beverly Hills and London: Sage Publications, 1978), 18.

⁵ Wayne M. Gibbons, "Joint Vision 2010: The Road Ahead," Joint Warfighting Center Articles, 14 January 1998, <<http://www.jwfc.js.mil/pages/FS/road.htm>> (27 March 1998).

⁶ ...From the Sea, 9.

essential for joint operations projected to occur in the first part of the 21st century. The aircraft carrier of today possesses a number of capabilities which, with some significant costs and drawbacks, fit well into the framework of Joint Vision 2010. Remarking on both current and future joint operations, then Chief of Naval Operations (CNO) Admiral Mike Boorda stated in 1995, "aircraft carriers work pretty well in the new regime. We need airplanes, so I think we'll keep the carriers ... We will not only keep the carriers, we'll buy three more. Aircraft carriers are a big part of the Navy today and part of the future."⁷ The 1993 Bottom-Up Review identified a requirement for 12 carriers; with the current inventory and approved construction plan, the Navy expects to maintain this force level well into the next century. By 2010, the aircraft carrier force will be made up exclusively of nuclear powered Nimitz class carriers, with the exception of the nuclear powered USS Enterprise (CVN-65) and the conventionally powered USS John F. Kennedy (CV-67).⁸ With an average service life of approximately fifty years, the potential exists for the aircraft carrier to make up a significant portion of the U.S. Navy's combat capability well into the next century.

The CVX, the Navy's 21st century replacement for the Nimitz class aircraft carriers, will soon move from the drawing board to construction. When the CVX program was inaugurated, the head of the CNO's Aircraft Carrier and Air Station Branch stated, "we're designing a potentially revolutionary class of aviation warships, the last units of which might still be around at the turn of the century!"⁹ With some new technologies scheduled to be tested in the final Nimitz class carrier, CVN-77, the first CVX class carrier is scheduled to

⁷ Scott C. Truver, "Tomorrow's Fleet - Part I," U.S. Naval Institute Proceedings, July 1996, 55.

⁸ Ibid.

⁹ Ibid., 56.

begin construction in 2006. While many of the design specifics are either under review or classified, the Navy released the CVX Feasibility Study early in 1998. This study recommends a large, 100,000-ton displacement, all electric, nuclear powered ship, with modular architecture in order to rapidly adapt to new technologies and weapon systems.¹⁰ This description sounds like a modernized and more flexible Nimitz class size carrier, utilizing electromagnetic catapults to replace today's steam versions, with only gradual evolutionary changes in airwing composition and capabilities. Rather than pursuing a different course with a small, ski-jump flight deck and VSTOL aircraft, the CVX vision described by the Office of Naval Research appears to be only a modernized and improved version of today's Nimitz class aircraft carrier.

Are There More Capable, Cost Effective Alternatives to the Aircraft Carrier?

What unique capabilities does the aircraft carrier bring to the Joint Force Commander today, in 2010, or beyond? It is true that naval forces can provide a mobile, dispersed, and fully integrated command and control system to the Joint Force Commander, without the requirement for nearby land facilities. They also serve as a visible reminder to both friend and foe of America's peacetime engagement, deterrence, and wartime capability. While an aircraft carrier may be the naval unit most capable of fulfilling these mission requirements, the capability it brings to the Joint Force Commander is not unique.¹¹

¹⁰ Office of Naval Research. "Navy report released; recommends aircraft carrier of the future."
<<http://www.onr.navy.mil/onr/newsrel/nr980128.html>> (29 April 1998).

¹¹ Jay L Johnson, Admiral., "The Navy in 2010: A Joint Vision," Joint Force Quarterly, Winter 1996-1997, 18.

The utilization of sea room for maneuver in order to gain a strategic, operational, or tactical advantage over an enemy has always been a tenet of naval forces. The advantage of being able to maneuver in open space, of forcing an enemy to defend all his coastline, and of choosing the time and location for one's attack can be appreciated by anyone who has ever done battle with a determined mosquito. While a nuclear powered aircraft carrier, due to its superior range and speed, may be the naval unit best able to maneuver for advantage, all naval forces possess the capability to maneuver with respect to enemy forces.¹²

Because of the natural desire to conserve forces and America's growing intolerance for friendly casualties, Full Dimensional Force Protection will be a critical concern for any U.S. joint force commander. U.S. naval forces, as they operate today and are likely to operate in the future, possess two inherent attributes that enhance their force protection capabilities. For the same reason that moving targets are difficult to attack, they are easier to defend. Whenever possible the commander will choose to keep his forces mobile in order to enhance their security.¹³

The other attribute enhancing force protection is the U.S. Navy's method of deploying units as members of an integrated battle group employing a layered defensive structure. At the center of a multi-layered and multi-dimensional protective screen, the aircraft carrier enjoys a comparative force protection advantage. This layered defensive structure serves to protect the battle group against air, surface, and subsurface threats. On a theoretical level, a three-layer defensive scheme, with each individual layer possessing an effective rate of 60%,

¹² Ibid.

¹³ Roger W. Barnett, Grasping 2010 with Naval Forces, Strategic Research Department Research Report 2-97, U.S. Naval War College, Newport RI, 1997, 23.

will have a combined effectiveness rate of 94%.¹⁴ As the integral component in a battle group's defensive structure, the aircraft carrier both contributes to, and benefits from, this force protection scheme.

Force protection considerations also apply to those weapon systems utilized. In order to decrease the vulnerability of aircraft involved in close air support or strategic deep strike missions, aircraft are increasingly turning to weapon systems that will allow them to fire from a standoff position. Weapon systems like the Joint Air-to-Surface Standoff Missile (JASSM) and the Joint Direct Attack Munition (JDAM) will allow aircraft to strike targets deep inside enemy territory from distances of up to 100 miles.¹⁵ While these and other similar weapon systems clearly increase the survivability of aircraft engaged in dangerous strike missions, they invite the question, "why utilize an aircraft when risk and investment can be minimized by launching the weapon from a ship?" Future technological advances are likely to eliminate the requirement for the aircraft, and launch the missile from either a surface or sub-surface vessel. While sub-surface ships may be less vulnerable than surface ships, they are also significantly more expensive and less capable of effectively performing the National Military Objective of conventional deterrence.

To summarize the discussion of force protection, vulnerability for all forces is directly related to the threat level. All naval forces benefit from their ability to use maneuver and a layered defensive scheme. Aircraft carriers, operating in international waters, are less politically and militarily vulnerable than forward deployed land and air forces. While aircraft carriers are more vulnerable than smaller ships to detection, their size makes them the hardest

¹⁴ Ibid., 22-23.

¹⁵ Tim Smart. "Lockheed Gets Missile Contract." The Washington Post. April 10, 1998, F03.

ships to sink and destroy, and they are less vulnerable in every other respect.¹⁶

As secure, interconnected mobile platforms, naval forces are uniquely suited to utilize precision weapons to attack critical enemy targets. With the exception of submarine launched nuclear equipped missiles, precision engagement by naval forces has been dominated by the aircraft carrier for almost forty years. Until the recent advent of precision guided surface to land missiles, such as the Tomahawk, the carrier based airwing was the only naval force capable of reaching out beyond the range of the conventional shipboard gun systems, which are generally limited to 12-24 miles. Without increased ship sensor capability, the aircraft launched from the carrier are the only naval forces capable of locating the target, generating the desired effect, assessing the level of success, and re-attacking if required. With technological advances currently fielded or in development, most surface ships of the 21st century will be capable of influencing, both operationally and tactically, the land campaign in support of the Marine Corps's *Operational Maneuver From the Sea* up to a range of 200 miles. Simultaneously they will be capable of providing strategic, precision deep strike out to a range of over 1000 miles. The systems currently being fielded or in development include the improved Tomahawk, naval versions of the Army Tactical Missile System (ATACAMS), and the five inch/62-caliber Extended Range Guided Munitions (ERGM) gun.¹⁷ While current technology precludes any of these conventional precision strike weapon systems from effectively attacking moving targets, technological advances in the not so distant future will likely continue to erode the aircraft carrier's comparative

¹⁶ Lehman, 40-41.

¹⁷ Daniel J. Murphy, Admiral. "Achieving 21st Century Naval Mastery." Surface Warfare. March/April 1998, 10.

advantage.¹⁸

While these advanced conventional precision strike systems will significantly increase the ability of both surface and sub-surface naval forces to conduct precision engagement, an unintended consequence of these improvements has changed the focus of the problem. During World War II, it took 1,500 B-17 sorties to destroy a 60 by 100-foot target with a 90 percent probability of kill (Pk). During the Vietnam War, it took 176 F-4 Phantom sorties to destroy the same target with the same Pk. During the Gulf War, the same Pk took only one F-117 sortie with one laser guided bomb. As technology allows us to gain ever-improving accuracy and we extend the range capabilities of all platforms, the challenge has shifted to locating and identifying targets.¹⁹

A significant amount of defense research is being devoted to improving target acquisition capabilities. The Defense Advanced Research Programs Agency (DARPA) is currently developing a variety of reconnaissance tools, concentrating on unmanned aircraft, ground-traveling robots, and sensor-laden satellites to decrease the risks to military personnel. Utilizing motion sensitive video, radar that penetrates foliage, and devices that detect both visible and infrared spectrums, DARPA hopes to give the commander comprehensive awareness of the battlefield by 2010.²⁰ Despite numerous efforts by the Services, and DARPA's own annual budget in excess of \$2.04 billion, it is probable that accurately locating the desired target will remain the weak link in the U.S. effort to achieve excellence in the operational concept of precision engagement for several more years.

¹⁸ John Birkler and others, A Framework for Precision Conventional Strike in Post-Cold War Military Strategy (Santa Monica, CA, National Defense Research Institute, 1996), 33

¹⁹ Barnett, 15.

²⁰ Walter Pincus, "From Tiny Aircraft to Robots and Radars, Pentagon Pursues New Tools," The Washington Post, March 29, 1998, A02.

The capabilities the aircraft carrier brings to the Joint Force Commander come with a significant amount of logistics baggage. While naval forces are likely the most self-sustaining of all military units, their logistics requirements are not insignificant. The fuel storage space (ship's service bunkers) saved in a nuclear powered aircraft carrier yields four times the aircraft fuel and three times the ammunition storage capacity compared to a conventionally powered carrier.²¹ While additional ammunition storage space may have been critical ten or twenty years ago, in an era increasingly reliant upon precision conventional strike weapons it is not a significant advantage. The theoretical advantage of a nuclear powered aircraft carrier--relative independence from outside logistics support--has not always been a practical advantage. This is primarily because the aircraft carrier rarely operates without its company of escort ships, all of which are conventionally powered. Additionally, slower-speed support ships carrying vital fuel and bulk supplies accompany all carrier battle groups.²² In this author's experience, underway replenishment of a deployed aircraft carrier must occur every 4-5 days, regardless of whether the ship is nuclear or conventionally powered.

In addition to their support ships, aircraft carriers and their battle groups depend on a steady stream of supply flights by C-2 aircraft carrying high priority parts and cargo. While the aircraft carrier may be operating in international waters, the C-2 aircraft requires a secure airfield ashore linked to the various supply agencies based in the continental United States. Despite dramatic improvements in parts tracking and usage data-bases, and the

²¹ Lehman, 52.

²² Hans M. Kristensen, William M. Arkin, Joshua Handler, Aircraft Carriers, The Limits of Nuclear Power, Neptune Papers, no. 7. (Washington D.C.: Greenpeace, 1994), 4.

implementation of the Readiness Based Sparing program throughout naval aviation, an almost daily influx of critical components is required by the aircraft carrier and the embarked airwing. Without regular C-2 deliveries to the deployed aircraft carrier, aircraft operability will rapidly deteriorate.

A further consideration is the classic economist's question of opportunity cost. In order to acquire and maintain an aircraft carrier and its airwing in a ready status, what amount of resources are required to be expended and what other forces then become unaffordable within the military's limited budget? While aircraft carriers make up approximately two percent of the number of ships scheduled for construction, they consume almost 20 percent of the Navy's annual shipbuilding and procurement budget.²³ The procurement costs for a new nuclear powered carrier, its embarked airwing, and the required support ships total approximately \$10 billion, with annual operating costs of approximately \$2 billion.²⁴ Nuclear powered aircraft carriers historically cost approximately 30% more to procure than conventionally powered carriers, a figure that will certainly affect the Navy's ability to continue to procure CVX class aircraft carriers in the future. From a lifecycle viewpoint, nuclear powered aircraft carriers are particularly expensive, requiring a lengthy mid-life modernization in order to complete their expected service life of fifty years. During this fifty years, a nuclear powered aircraft carrier will spend approximately sixteen years in the shipyard. At the end of its service life, decommissioning each nuclear powered aircraft carrier in the current inventory will cost an estimated \$600 million, or ten times the cost of

²³ Ibid., 41.

²⁴ Michael Wright, "Are Aircraft Carriers Obsolete?," Fortune, 14 October 1996, 44.

decommissioning a conventionally powered aircraft carrier.²⁵ A 1995 General Accounting Office analysis concluded, "a conventional carrier force structure would require less budget authority funding and fewer outlays than any force structure that continues to require building nuclear aircraft carriers."²⁶ The GAO arrived at this conclusion even when the annualized life-cycle costs for additional fleet oiler assets were considered.

Summary

While there certainly will be follow-ups and updates to JV 2010, the importance of its four core competencies of information, force protection, precision strike, and focused logistics will, in some variation, remain with us. These four core competencies, restated in modern terms, are themes and ideas that have been validated throughout history. While rational men may examine the same data and reach opposing conclusions, the evidence reviewed above does support the following:

- A careful review of the above information leads the author to conclude that, while the aircraft carrier is not yet obsolete, its days are numbered. A reasonable estimate from a variety of sources leads me to suggest that the aircraft carrier will become obsolete within the next fifty years. As precision strike weapon systems and sensors become increasingly sophisticated, the comparative advantage the aircraft carrier holds over both surface and sub-surface ships will be eliminated. At the same time, advanced precision strike weapon systems and sensors in the hands of an enemy will make the aircraft carrier and its crew

²⁵ Kristensen., 43.

²⁶ U.S. General Accounting Office. Navy's Aircraft Carrier Program: Investment Strategy Options. Washington D.C. 1995, 8.

of 6,000 an increasingly attractive target.

- As the future unfolds, the aircraft carrier will require increasing amounts of resources from a dwindling budget base while providing less and less of the force capability to the JFC. Aircraft carriers with their necessary airwing complements will increasingly provide a significantly more expensive bang for the buck when stacked up against the rapidly expanding precision conventional strike capabilities of the Navy's surface forces.
- Aircraft carriers are manpower intensive, regularly deploying with between 5,500 and 6,000 personnel. Even if force protection issues can be adequately resolved, the Navy will find it increasingly difficult to devote the necessary manpower resources while reducing overall manning. The crew size of an aircraft carrier makes it expensive to man, a choice target of the enemy, and requiring a significant amount of logistics support.
- Nuclear powered carriers, which will soon make up 100 percent of the carrier inventory, are significantly more expensive than conventional carriers. This is true whether one focuses on initial procurement costs, annualized operating costs, or life cycle costs. Nuclear powered aircraft carriers, while providing a theoretical advantage over conventionally powered carriers due to their lack of ship's service fuel requirements and increased ammunition and aircraft fuel storage capacity, are increasingly unable to take advantage of these factors in the real world. In view of increased costs and unrealized advantages, whatever type of warship eventually replaces the current inventory of Nimitz class aircraft carriers should be conventionally powered. Additionally, cost benefit analysis should be performed to determine the advisability of investing significant additional resources to perform mid-life refueling for nuclear powered aircraft carriers

that may be retired before they reach their full fifty year service life.

**Will a "Pearl Harbor" type event be required for the US Navy to recognize the day
of the aircraft carrier will soon end?**

Any proposal to draw down the carrier inventory will likely meet massive political opposition, primarily from within the U.S. Navy, but also from affected legislators and commercial vendors. With approximately 25-30% of the Navy's Flag officers members of the naval aviation community, including the current Chief of Naval Operations, internal resistance to any plan designed to reduce and eventually eliminate the aircraft carrier can be expected to meet strong resistance. Opposition from the Marine Corps can be expected until adequate tactical and operational fires capability from other naval assets can be assured. Although currently only one shipyard, located in Newport News, Virginia, is qualified to build nuclear powered aircraft carriers, the web of vendors and subcontractors extends across the United States. Another industry group which can be expected to oppose the drawdown of the aircraft carrier force is the airline industry, which enjoys being able to hire trained and experienced pilots.

Another danger for the US Navy will arise from the current congressional budgeting process. Just because the Navy no longer requires the billions of dollars previously earmarked for aircraft carrier procurement and operations is no guarantee that those same billions of dollars will be allocated for the required replacement surface ships and weapon systems. The other Services and other government programs can be expected to compete for the funds they see becoming available.

The transition from an aircraft carrier centered force will challenge the Navy's leadership to maintain an adequate forward presence in order to accomplish the National Military Strategy's peacetime engagement, deterrence and conflict prevention, and "fight and win" when deterrence fails. Optimizing the deployment schedule of the dwindling inventory of aircraft carriers, to include pursuing overseas homeport options in either the Mediterranean or the Persian Gulf, will be required while additional surface ships with expanded precision strike capabilities are constructed.

Managing the drawdown of both ships and personnel, while maintaining opportunities for career aviation personnel and adequate force levels throughout the transition will be a complex and demanding task. The most daunting task, that of recognizing the need to replace aircraft carriers and overcoming institutional inertia without some catastrophic event to force change upon the US Navy, will be more palatable if the decision is made by a CNO from the Naval Aviation community. While it took the disaster of Pearl Harbor to end the long simmering dispute between battleship and carrier advocates, this author sincerely hopes that advances in modeling, wargaming, and simulation technology will enable the US Navy's leadership to recognize that the days of the aircraft carriers are numbered.

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